

REMARKS

I. Amendment

Claim 1 has instantly been amended.

Specifically, the surface roughness (Ra) is amended from “not more than 2 nm” to “not more than 1.5 nm”. Support for this amendment is found at page 55, line 16 of the specification of the present application.

Further, additional characteristic “(d) a reflectance of not more than 1 %” has instantly been introduced into claim 1. Support for this amendment is found at page 75, lines 22-25 of the specification of the present application.

No new matter has been added by way of the above-amendment.

II. Restriction Requirement

The Examiner has restricted the claims under 35 USC 121 and 372 as follows:

Group I: Claims 1-6;
Group II: Claims 7-8; and
Group III: Claims 9-18.

Applicants confirm the election with traverse of Group I, claims 1-6.

Based upon the Examiner's comments, the Examiner appears to be aware that the present application is a national phase 371 application, and as such, the claims should be reviewed under unity of invention practice without regard to the practice in national applications filed under 35 USC 111.

Rule 13.1 states:

[t]he international application shall relate to one invention only or to a group of inventions so linked as to form a single general inventive concept ("requirement of unity of invention").

According to Rule 13.2, the requirement for unity of invention “shall be fulfilled only when there is a technical relationship among those inventions involving one or more of the same or corresponding special technical features. The expression ‘special technical features’ shall mean

those technical features that define a contribution which each of the claimed inventions, considered as a whole, makes over the prior art.”

However, even though the Examiner cites to PCT Rules 13.1 and 13.2, the Examiner’s rationale for lack of unity is the rationale used in restriction practice in national applications filed under 35 USC 111. The Examiner gives reasons why there would be a burden on the Examiner to search and consider all of the claims, see the paragraph bridging pages 2-3 of the outstanding Office Action. The concept of a burden on the Examiner is not even mentioned in the Unity of Invention section 1850 of the MPEP.

Furthermore, Applicants have amended claim 1 to distinguish over the cited art, and as such, there is a special technical feature that defines a contribution over the prior art.¹

Accordingly, Applicants respectfully request rejoinder of Group I-III.

III. Rejection of claims 1-3 under 35 U.S.C. § 102(b)

Claim 1-3 have been rejected under 35 U.S.C. 102(b) as anticipated by Toshiaki et al. (JP-2002-079600). Specifically, with respect to claim 1, the Examiner states that all of the characteristics (including “a silicon atom % of 10 %”) recited in claim 1 are disclosed in Toshiaki et al. except that this reference “does not specifically disclose that the atom % value is obtained by x-ray spectroscopy” but “the measurement being obtained by this limitation is inherent”.

Traverse is made as follows.

As mentioned in item /I/ above, claim 1 has instantly been amended to change the surface roughness (Ra) (characteristic (b)) from “not more than 2 nm” to “not more than 1.5 nm” and to add a characteristic “(d) a reflectance of not more than 1 %”. In the present invention, it is especially important to simultaneously satisfy characteristic (b) (specific surface roughness (Ra)) and characteristics (c) (specific surface silicon atom content) while maintaining the reflectance at

¹ Applicants are not aware of instructions in the MPEP that the determination of a special technical feature in the claims is solely made before prosecution begins and that the special technical feature cannot be added during prosecution by amendment.

not more than 1 % (characteristic (d)). Toshiaki et al. teach or suggest neither characteristic (b) (see Comparative Example 1 as explained below) nor characteristic (c), and, of course, have no teaching or suggestion about the importance of the combination of characteristics (b), (c) and (d). More specific explanation is made below.

Firstly, regarding characteristic (c) which is "silicon atom content of 10 atom % or more, as measured by X-ray photoelectron spectroscopy (XPS) with respect to the surface of the antireflection film" (claim 1), contrary to the Examiner's recognition, Toshiaki et al. do not disclose this characteristic at paragraph [0009]. Paragraph [0009] of Toshiaki et al. reads as follows:

"[0009] The invention of claim 4 is characterized in that, in the antireflection laminate of any one of claims 1 to 3, the above-mentioned inorganic ultrafine particles are silica sol particles, 10 % or more of which have particle diameters within the range of from 50 to 100 nm, and the content of the silica sol particles in the low refractivity composition coating is in the range of from 40 to 80 %".

Thus, the "10 % or more" in paragraph [0009] does not refer to the silicon atom content measured with respect to the surface of the antireflection film (hereinafter, simply referred to as "surface silicon atom content"), but refers to the percentage of the particles having specific sizes in the silica sol particles used in the low refractivity composition coating.

Further, it should be noted that the antireflection film of the present invention needs to have not only a surface silicon atom content of 10 atom % or more (characteristic (c)) but also characteristic (a): silica particle content of 30 % by weight or more; characteristic (b): arithmetic means surface roughness (Ra) of not more than 1.5 nm; and characteristic (d): reflectance of not more than 1 %. Especially, characteristics (b), (c) and (d) in combination mean a feature that the antireflection film of the present invention has a relatively smooth surface in spite of the presence of a relatively large amount of silica particles in the surface portion of the antireflection film, and has an advantageously low reflectance in spite of the presence of a relatively large amount of silica particles in the surface portion of the antireflection film. (It is generally

considered that the smaller amount of silica particles increases the pore volume of an antireflection film, which in turn lowers the reflectance of an antireflection film.) This feature has unexpectedly solved the technical dilemma of the prior art. On this point, more specific explanations are made below.

As discussed in the present specification under "Prior Art", various studies have conventionally been made for developing an antireflection film which not only has excellent antireflection performance, but also excellent properties with respect to mechanical strength, such as surface hardness and abrasion resistance. In this connection, it should be noted that the conventional antireflection films suffer a trade-off between the antireflection performance and the mechanical strength.

Conventionally, it has been attempted to improve the surface hardness and abrasion resistance of an antireflection film by incorporating silica particles into the surface portion of an antireflection film to thereby form minute unevenness on the surface of the antireflection film (i.e., to form minute dents and bumps so as to roughen the surface) as have been done in Toshiaki et al. This attempt improves the abrasion resistance to some extent, since the presence of minute dents and bumps on the surface of the antireflection film can decrease the practical contact area between the antireflection film and an object which is placed in contact with the surface of the antireflection film. However, this technique is problematic in that the above-mentioned trade-offs remain unsolved (that is, the antireflection performance is sacrificed as a result of the improvement of the surface hardness and the abrasion resistance) as explained later in more detail referring to Table 1 of Toshiaki et al., and a stress applied to the surface of the antireflection film is inevitably mainly focused on the minute "peak top" portions of the roughened surface and, hence, the surface portion of the antireflection film is partially scraped off and/or the antireflection film is partially crushed in the thicknesswise direction, leading to a partial lowering of thickness of the antireflection film, and this will cause an inadvertent change in the color tone of the antireflection film. Thus, conventionally, there has been a technical dilemma that the surface hardness and abrasion resistance of an antireflection film are improved by incorporating the silica particles into the surface portion of an antireflection film to roughen the surface thereof; however, the incorporation of such silica particles in turn results not only in

unsatisfactory antireflection performance, but also in inadvertent change in the color tone of the antireflection film.

In this situation, the present inventors have made extensive and intensive studies with a view toward solving the above-mentioned technical dilemma accompanying conventional techniques as disclosed in Toshiaki et al. As a result, it has surprisingly been found that the above-mentioned problems can be solved by a specific antireflection film as defined in claim 1 of the present application, which has the following characteristics (a) to (c):

- (a) a silica particle content of 30 % by weight or more, based on the weight of the antireflection film,
- (b) an arithmetic mean surface roughness (Ra) of not more than 1.5 nm,
- (c) a silicon atom content of 10 atom % or more, as measured by X-ray photoelectron spectroscopy (XPS) with respect to the surface of the antireflection film.

As described in detail below, due to the above-mentioned characteristics (a) to (c), the antireflection film of the present invention exhibits not only a reflectance of not more than 1 % (which is now also recited in claim 1 as characteristic (d)) but also has excellent mechanical strength without sacrificing the color of the antireflection film.

In connection with the above, it should be noted that the present inventors have found that such an antireflection film which has all of the above-mentioned characteristics (a), (b), (c) and (d) can be obtained by a specific method using a transfer foil (hereinafter, "transfer foil method"). Specifically, the specific transfer foil method used in the present invention is a method comprising the steps of:

- (1) providing a transfer foil comprising a provisional substrate and, laminated thereon, the antireflection film of the present invention,
- (2) laminating the transfer foil on an optical substrate so that the antireflection film is in contact with the optical substrate; and
- (3) delaminating the provisional substrate of the transfer foil to transfer the antireflection film onto the optical substrate, thereby obtaining a structure in which the antireflection film of the present invention is formed on the optical substrate (see page 67, line 14 to page 68, line 4 of the specification of the present application).

This method has, for the first time, enabled the production of an antireflection film having all of the above-mentioned characteristics (a), (b), (c) and (d).

With respect to the critical importance of satisfying all of the above-mentioned characteristics (a), (b) and (c) for achieving not only a reflectance of not more than 1 % (characteristic (d)) but also excellent mechanical strength without sacrificing the color of the antireflection film, attention is drawn to Table 1 on page 99 of the specification of the present application, which shows the results of Examples 1 and 2 and Comparative Examples 1 to 3 of the present application. In each of these Examples 1 and 2 and Comparative Examples 1 to 3, an optical part having an antireflection film was produced and evaluated. For easy reference, the data of Table 1 are rearranged and shown in Table 1 below.

TABLE 1

	Minimum Reflectance (%)	Wavelength at which the reflectance becomes minimum (nm)	Arithmetic mean roughness (Ra) (nm)	Surface silicon atom content (at.%)	Abrasion resistance	Pencil hardness
Example 1	0.82	531	0.5	21.6	No abrasion marks or no discoloration observed	
Comp. Ex. 1	0.82	518	2.5	22.7	Many abrasion marks and discoloration observed	
Example 2	1.00	600	0.9	16.1	No abrasion marks or no discoloration observed	3H
Comp. Ex. 2	0.20	450	4.0	28.3	Many abrasion marks and discoloration observed	2H
Comp. Ex. 3	1.41	560	0.9	9.2	No discoloration observed, but many abrasion marks observed	

In Example 1 and Comparative Example 1, the same composition ("composition A") is used for forming the low refraction layers, and the same composition ("composition B") is used for forming the high refraction layers.

In Example 2 and Comparative Example 2, the same composition ("composition B") is used for forming the low refraction layers (no high refraction layer is formed).

Table 1 above clearly shows:

that the optical part obtained in Example 1 (which satisfies all of the requirements of characteristics (a), (b) and (c)) exhibits excellent properties, i.e., a minimum reflectance as low as 0.82 % (which satisfies the instantly introduced characteristic (d)), and excellent abrasion resistance (no abrasion mark or no discoloration occurred), whereas the optical part obtained in Comparative Example 1 (which has a Ra value exceeding 2 % as in Toshiaki et al.) exhibits satisfactory optical property (minimum reflectance of 0.82 %) but exhibits very poor abrasion resistance (many abrasion marks and discoloration occurred),

that the optical part obtained in Example 2 (which satisfies all of the requirements of characteristics (a), (b) and (c)) exhibits excellent properties, i.e., a minimum reflectance as low as 1.00 % (which satisfies the instantly introduced characteristic (d)), excellent abrasion resistance (no abrasion mark or no discoloration occurred) and a pencil hardness as high as 3H, whereas the optical part obtained in Comparative Example 2 (which has a Ra value exceeding 2 % as in Toshiaki et al.) exhibits satisfactory optical property (minimum reflectance of 0.20 %) but exhibits very poor abrasion resistance (many abrasion marks and discoloration occurred) and a low pencil hardness of 2H, and

that the optical part obtained in Comparative Example 3 (which does not satisfy characteristic (c) (surface silicon atom content)) exhibits a poor optical property (minimum reflectance of 1.41 %) and a poor abrasion resistance (no discoloration observed, but many abrasion marks observed).

Therefore, it is apparent that all of the requirements of characteristics (a), (b) and (c) are necessary to improve the mechanical strength (such as surface hardness and abrasion resistance) of an antireflection simultaneously with the antireflection performance (so as to satisfy characteristic (d)) film without sacrificing the color of the antireflection film.

On the other hand, the antireflection laminate of Toshiaki et al. has a surface roughness (Ra) value of 2 to 10 nm (claim 1), which is higher than the range ("not more than 1.5 nm", i.e., characteristic (b)) recited in amendment claim 1 of the present application. Further, Toshiaki et al. have no teaching or suggestion about the specific surface silicon atom content as defined in characteristic (c) of the present invention. Needless to say, Toshiaki et al. have no teaching or suggestion about the importance of the combination of characteristics (b) and (c) in the improvement of the mechanical strength (such as surface hardness and abrasion resistance) and antireflection performance of an antireflection film without sacrificing the color of the antireflection film.

Furthermore, with respect to the Examples and Comparative Examples of Toshiaki et al., attention is drawn to Table 1 on page 7 of Toshiaki et al., an English translation of which is shown below.

Toshiaki et al's Table 1

		Ex.1	Ex.2	Ex.3	Comp. Ex.1	Comp. Ex.2
Amounts (part by weight)	A	-	30	-	70	-
	B	60	30	-	-	-
	C	-	-	80	-	-
	D	40	40	20	30	40
	E	-	-	-	-	60
Surface roughness						
Rz (nm)						
Ra (nm)		70	30	50	10	95
		7	4	5	1	12
Reflectance (%)		1.2	1.5	1.5	2.9	1.3
Haze (%)		0.7	0.4	0.5	0.3	4.5
Adhesion		100	100	100	100	90
Pencil Hardness		2H	3H	3H	H	H
Abrasion resistance		Slight scratch	No scratch	No scratch	Large number of scratches	Extremely large number of scratches

Table 1 of Toshiaki et al. shows that the antireflection films according to this reference suffer the above-mentioned trade-off between the antireflection performance and the mechanical strength. Specifically, the antireflection films obtained in the Examples 1 to 3 of Toshiaki et al. have satisfactory hardness and abrasion resistance; however, the antireflection performance is sacrificed. Especially, in Examples 2 and 3 where the pencil hardness is as high as 3H and the abrasion resistance is also good; however, instead, the reflectance is unfavorably high (1.5 %).

As already mentioned above, as can be seen from Table 1 (on page 12 above), the antireflection film of the present invention obtained in Example 2 has a reflectance as low as 1.0 % despite that the pencil hardness is as high as 3H and the abrasion resistance is very high.

Further, in Comparative Example 1 of Toshiaki et al., an antireflection film satisfying characteristics (a) and (b) is obtained; however, this antireflection film has poor hardness and abrasion resistance, and a disadvantageous high reflectance (2.9 %) which is much higher than the upper limit (1 %) recited in claim 1 of the present application. That is, Comparative Example 1 of Toshiaki et al. shows that a small Ra value is disadvantageous not only in that the mechanical properties of the antireflection film become poor, but also in that the reflectance of the antireflection film becomes high. Thus, Toshiaki et al. have only a negative teaching against the Ra value of "not more than 1.5 nm".

As explained above, the excellent effects of the present invention (i.e., the effects that the antireflection film not only has an excellent optical property, but also is improved with respect to mechanical strength, such as surface hardness and abrasion resistance, without sacrificing the color of the antireflection film) can be obtained only when the antireflection film satisfies all of the above-mentioned requirements (a), (b) and (c) which are recited in claim 1 of the present application. Further, such an excellent antireflection film of the present invention has, for the first time, been obtained by the use of the above-mentioned transfer foil method which is not taught or suggested in Toshiaki et al.

From the above, it is apparent that the present invention is neither anticipated by nor obvious over Toshiaki et al. As such, withdrawal of the rejection is respectfully requested.

IV. Rejection of claims 4-6 under 35 U.S.C. § 103(a)

Claims 4-6 have been rejected under 35 U.S.C. 103(a) as being obvious over Toshiaki et al. (JP-2002-079600) in view of Scholz et al. (US Patent No. 5,585,186). Specifically, the Examiner takes a position that the characteristics recited in claim 1 are taught in Toshiaki et al., while additional characteristics recited in claims 4-6 are taught in Scholz et al. so that claims 4-6 are obvious over Toshiaki et al. in view of Scholz et al.

However, as already mentioned in item III above, the antireflection film of claim 1 is not anticipated by Toshiaki et al. In addition, Scholz et al. do not teach or suggest the importance of characteristics (a), (b) and (c) recited in claim 1 of the present application.

Therefore, it is apparent that claims 2 to 6 of the present application are not obvious over Toshiaki et al. even in view of Scholz et al. As such, withdrawal of the rejection is respectfully requested.

V. Conclusion

It is believed that the present application is now in condition for allowance.

Reconsideration and early favorable action are earnestly solicited.


In view of the above amendment, applicant believes the pending application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Garth M. Dahlen, Reg. No. 43,575 at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.147; particularly, extension of time fees.

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Respectfully submitted,

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